

Claims

[c1] 1. An apparatus limiting the arc of rotation of an axially elongated rod about its longitudinal axis in either of opposite rotational directions, comprising:
an adjustable stop assembly, useable with an axially elongated rod that is rotatable about its longitudinal axis, mountable for rotation with the rod, and establishing a stop assembly pathway about the longitudinal axis of the rod;
first and second pivot arms, juxtaposed to said stop assembly, positioned with either one of said pivot arms extending into an interference position with said stop assembly pathway such that the adjustable stop assembly will strike the interfering pivot arm in one of the opposite rotational directions, and positioned with the other pivot arm displaced from the interference position;
and
a mechanism for linking the first and second pivot arms for common movement and moving either pivot arm into the interference position when the other pivot arm exits the interference position;
wherein, when in the interference position, each pivot arm is positioned to respond to being struck by said

stop assembly from a one of the rotational directions by braking the stop assembly and to respond to being struck by the stop assembly from the opposite rotational direction by exiting the interference position; wherein the first and second pivot arms respond mutually oppositely to being struck in the respective opposite rotational directions; and whereby the arc of rotation of the rod about its longitudinal axis in one of the rotational directions is limited by one of the pivot arms braking the stop assembly in response to the stop assembly striking the pivot arm in the one rotational direction.

[c2] 2. The apparatus of claim 1, wherein said stop assembly comprises:

first and second collars coaxially mountable on the rod at separate axial heights; and a first stop carried by said first collar and, when the first collar is mounted on the rod, moveable with the first collar in a first annular path around the longitudinal axis of the rod; and a second stop carried by said second collar and, when the second collar is mounted on the rod, moveable with the second collar in a second annular path around the longitudinal axis of the rod.

- [c3] 3. The apparatus of claim 2, wherein said first and second collars are split collars.
- [c4] 4. The apparatus of claim 2, wherein said stop assembly further comprises:
means for variably establishing an angle between said first and second stops to establish a preselected included angle when the collars are positioned coaxially on the rod.
- [c5] 5. The apparatus of claim 4, wherein said means for variably establishing an angle between said first and second stops comprises:
means for adjusting the rotational position of at least one of said first and second collars with respect to the other.
- [c6] 6. The apparatus of claim 4, wherein said means for variably positioning the first and second stops about the longitudinal axis of the rod comprises:
means for adjusting the rotational position of both of said first and second collars with respect to the rod.
- [c7] 7. The apparatus of claim 4, wherein said stop assembly further comprises:
means for variably positioning the first and second stops about the longitudinal axis of the rod, when the collars

are positioned on the rod, to dispose said included angle at a preselected angle offset with respect to a selected index position of the rod.

- [c8] 8. The apparatus of claim 7, wherein said first pivot arm is aligned with the first stop, such that the first pivot arm is selectively moveable into and out of interference position with said first annular path of the first stop, and such that when positioned in said interference position, the first pivot arm can be struck by the first stop in either of two rotational directions, a strike in one of the directions causing the first pivot arm to exit the interference position with the first annular path, and a strike in the second direction braking the first stop.
- [c9] 9. The apparatus of claim 8, wherein said second pivot arm is aligned with the second stop, such that the second pivot arm is selectively moveable into and out of an interference position with said second annular path of the second stop, and such that when positioned in said interference position, the second pivot arm can be struck by the second stop in either of two rotational directions, a strike in one of the directions causing the second pivot arm to exit interference position with the second annular path, and a strike in the second direction braking the second stop.

- [c10] 10. The apparatus of claim 9, wherein said first and second pivot arms are positionable at offset axial positions with respect to the axis of the rod such that the first pivot arm is mountable at the axial height of said first collar and the second pivot arm is mountable at the axial height of said second collar.
- [c11] 11. The apparatus of claim 10, wherein said first and second pivot arms are carried on a common base.
- [c12] 12. The apparatus of claim 10, wherein said rod is a steering shaft of a vehicle having a floor; and said common base is mountable to the floor of the vehicle.
- [c13] 13. In a vehicle having an axially elongated steering shaft that is rotatable about its longitudinal axis, an apparatus selectively limiting the available arc of rotation of the steering shaft about its longitudinal axis, comprising:
 - a variably positionable and variably sizeable stop assembly carried on said steering shaft, establishing a stop assembly pathway about the longitudinal axis of the steering shaft through which the stop assembly is moveable with rotation of the steering shaft in opposite first and second rotational directions;
 - first and second pivot arms variably positioned such that

either selected pivot arm is in the stop assembly pathway and the other pivot arm is displaced from the stop assembly pathway; and

a linking mechanism between the first and second pivot arms, responding to either pivot arm being displaced from the stop assembly pathway by moving the other pivot arm into the stop assembly pathway; wherein the first pivot arm is structured such that if the stop assembly strikes the first pivot arm in the stop assembly pathway in the first direction of rotation, the stop assembly engages the first pivot arm in a braking relationship, and if the stop assembly strikes the first pivot arm in the second direction of rotation, the stop assembly displaces the first pivot arm from the stop assembly pathway; and

wherein the second pivot arm is structured such that if the stop assembly strikes the second pivot arm in the stop assembly pathway in the second direction of rotation, the stop assembly engages the second pivot arm in a braking relationship, and if the stop assembly strikes the second pivot arm in the first direction of rotation, the stop assembly displaces the second pivot arm from the stop assembly pathway;

whereby the rotation of the steering shaft about its longitudinal axis in one of the two rotational directions is limited by the stop assembly engaging at least one of the

two pivot arms in a braking relationship.

- [c14] 14. The apparatus of claim 13, wherein said stop assembly comprises:
 - first and second collars coaxially mounted on said steering shaft at relatively offset axial positions; and
 - a first stop carried by said first collar and moveable with the first collar in a first annular path around the longitudinal axis of the steering shaft; and
 - a second stop carried by said second collar and moveable with the second collar in a second annular path around the longitudinal axis of the steering shaft.
- [c15] 15. The apparatus of claim 14, wherein said first and second collars are split collars having a means for securely fastening the collars to a shaft.
- [c16] 16. The apparatus of claim 14, wherein said stop assembly further comprises:
 - means for variably establishing an angle between said first and second stops, establishing a preselected included angle.
- [c17] 17. The apparatus of claim 16, wherein said means for variably establishing an angle between said first and second stops comprises:
 - means for adjusting the rotational position of at least

one of said first and second collars with respect to the other.

- [c18] 18. The apparatus of claim 16, wherein said means for variably positioning the first and second stops about the longitudinal axis of the steering shaft comprises:
means for adjusting the rotational position of both of said first and second collars with respect to the steering shaft.
- [c19] 19. The apparatus of claim 16, wherein said stop assembly further comprises:
means for variably positioning the first and second stops about the longitudinal axis of the steering shaft, disposing said included angle at a preselected angle offset with respect to a selected index position of the steering shaft.
- [c20] 20. The apparatus of claim 19, wherein said first pivot arm is positionally and directionally associated with the first stop, such that the first pivot arm is selectively moveable into and out of an interference position with said first annular path of the first stop, and such that when positioned in said interference position, the first pivot arm can be struck by the first stop in either of two rotational directions, a strike in one of the directions causing the first pivot arm to move out of interference position with the first annular path, and a strike in the

second direction braking the first stop.

- [c21] 21. The apparatus of claim 20, wherein said second pivot arm is positionally and directionally associated with the second stop, such that the second pivot arm is selectively moveable into and out of an interference position with said second annular path of the second stop, and such that when positioned in said interference position, the second pivot arm can be struck by the second stop in either of two rotational directions, a strike in one of the directions causing the second pivot arm to move out of interference position with the second annular path, and a strike in the second direction braking the second stop.
- [c22] 22. The apparatus of claim 21, wherein said first and second pivot arms are positionable at offset axial positions with respect to the longitudinal axis of the steering shaft such that the first pivot arm is mountable at the axial position of said first collar and the second pivot arm is mountable at the axial position of said second collar.
- [c23] 23. The apparatus of claim 22, wherein said first and second pivot arms are carried on a common base.
- [c24] 24. The apparatus of claim 22, wherein:
the vehicle includes a floor panel transverse to said

steering shaft, penetrated by the steering shaft; and said common base is mounted to said floor panel in juxtaposition to said steering shaft.

[c25] 25. A method for limiting the arc of rotation of an axially elongated rod about its longitudinal axis, comprising:
first, mounting a pair of stops on an axially elongated rod that is rotatable about its longitudinal axis, thereby establishing a stop pathway occupied by said pair of stop during rotation of the rod;
second, mounting a pair of first and second pivot arms in a position juxtaposed to the pair of stops, wherein the pivot arms are linked to be alternately pivotable into and out of an interference position with the stop pathway, and wherein the pair of pivot arms is positioned such that:
(a) the first pivot arm brakes the rod when one of the stops strikes the first pivot arm in a first rotational direction;
(b) the second pivot arm brakes the rod when one of the stops strikes the second pivot arm in a second rotational direction;
(c) the first pivot arm is displaced out of said interference position and the second pivot arm is moved into the interference position when one of said stops strikes the first pivot arm in said second rotational direction;

and

(d) the second pivot arm is displaced out of said interference position and the first pivot arm is moved into the interference position when one of said stops strikes the second pivot arm in said first rotational direction; third, positioning a selected one of the first and second pivot arms in the interference position; and fourth, rotating the rod in a direction selected from the first and second rotational directions until one of the stops strikes one of the pivot arms in a direction such that the pivot arm brakes the rod, thus limiting the arc of rotation of the rod.